CLAIMS

What is claimed is:

Sub B2

1. A circularly polarized single-feed microstrip resonant sensor for the purpose of measuring a sample dielectric property.

2. The sensor in claim 1 that measures sample dielectric properties with a fixed air gap between the sensor and the sample.

3. The sensor in claim 1 that measure samples dielectric properties within 2.5 λ of the sensor.

4. The sensor in claim 1 that measures sample dielectric properties within 2.5 λ of the sensor and with a fixed air gap between the sensor and the sample.

5. A single-feed microstrip resonant sensor with multiple modes and multiple polarizations.

6. The senor in claim 5 that measures sample dielectric properties with a fixed air gap between the sensor and the sample.

7. The sensor in claim 5 that measures sample dielectric properties within 2.5 λ of the sensor.

8. The sensor in claim 5 that measures sample dielectric properties within 2.5 λ of the sensor and with a fixed air gap between the sensor and the sample.

9. A circularly polarized, dual-feed microstrip resonant sensor that measures sample dielectric properties.

10. The sensor in claim 9 that measures sample dielectric properties with a fixed air gap between the sensor and the sample.

11. The sensor in claim 9 that measures sample dielectric properties within 2.5 λ of the sensor.

12. The sensor in claim 9 that measures sample dielectric properties within 2.5 λ of the antenna and with a small, consistent air gap between the antenna and the sample.

13. A two feed microstrip resonant sensor where one feed excites a horizontal mode of the sensor and the another feed independently excites a vertical mode of the sensor and both modes are at the same resonant frequency.

14. The sensor in claim 13 that measures sample dielectric properties with a fixed air gap between the antenna and the sample.

15. The sensor in claim 13 that measures sample dielectric properties within 2.5 λ of the sensor.

16. The sensor in claim 13 that measures sample dielectric properties within 2.5 λ of the antenna and with a fixed air gap between the antenna and the sample.

17. A two feed microstrip resonant sensor wherein one feed excites a horizontal mode of sensor and the other feed independently excites the vertical mode of the sensor and both modes are at a different resonant frequency.

18. The sensor in claim 17 that measures sample dielectric properties with a small but fixed air gap between the sensor and the sample.

19. The sensor in claim 17 that measures sample dielectric properties within 2.5 λ of the sensor.

20. The sensor in claim 17 that measures sample dielectric properties within 2.5 λ of the sensor and with a fixed air gap between the sensor and the sample.

21. A multi-feed (N>2) microstrip resonant sensor wherein the different feeds primarily excite one of the many modes of the resonant sensor and all modes are the same frequency.

22. The sensor in claim 21 that measures sample dielectric properties with a fixed air gap between the sensor and the sample.

23. The sensor in claim 21 that measures sample dielectric properties within 2.5 λ of the sensor.

24. The sensor in claim 21 that measures sample dielectric properties within 2.5 λ of the sensor and with a fixed air gap between the antenna and the sample.

25. A multi-feed (N>2) microstrip resonant sensor wherein the different feeds primarily excite one of a plurality of modes of the resonant sensor and all modes are at different frequencies.

26. The sensor in claim 25 that measures sample dielectric properties with a fixed air gap between the sensor and the sample.

27. The sensor in claim 25 that measures sample dielectric properties within 2.5 λ of the sensor.

28. The sensor in claim 25 that measures sample dielectric properties within 2.5 λ of the antenna and with a fixed air gap between the sensor and the sample.

29. A multi-feed (N>2) microstrip resonant sensor wherein the different feeds primarily excite one of many modes of the resonant sensor and some modes share different resonant frequencies.

30. The sensor in claim 29 that measures sample dielectric properties with a fixed air gap between the sensor and the sample.

31. The sensor in claim 29 that measures sample dielectric properties within 2.5 λ of the sensor.

32. The sensor in claim 29 that measures sample dielectric properties within 2.5 λ of the sensor and with a fixed air gap between the sensor and the sample.

33. The sensor of Claim 29 further comprising drive circuitry to detect the individual polarizations to make dielectric measurements.

34. The sensor of Claim 29 further comprising a fixed air gap between the resonant dielectric sensor and the sample under test.

35. The sensor of Claim 29 further comprising a fixed air gap enforced with a dielectric radome to separate a resonant dielectric sensor from the sample.

36. A method of using phase information to detect a resonance frequency of a resonant dielectric sensor.

37. A method of using a microstrip dielectric resonant sensor to determine bottle contents.

38. A method of using a microstrip dielectric resonant sensor to determine container contents.

39. A method of using a microstrip dielectric resonant sensor to determine mixture ratio of materials in a free-standing container.